Congenital convex pes valgus (congenital vertical talus) is a rare condition. We reviewed ten feet in seven patients who had had surgical correction. All had been operated on by the senior author (JF) and the same surgical technique was used throughout, incorporating transfer of the tibialis anterior to the neck of the talus. The mean age at surgery was 31 months and the mean follow-up was nine years (6 to 14). All patients completed a questionnaire and had clinical, radiological and photographic evaluation performed by an independent examiner.

None had required further surgery. All but one were satisfied with the result, and had no functional limitations. They all wore normal shoes. The mean ankle dorsiflexion was 17° and plantar flexion 21°. The mean arc of subtalar motion was 27°. All radiological parameters measured were within the normal range, although irregularity of the talonavicular joint was common. No avascular necrosis of the body of the talus was seen. We conclude that the medium-term results of this procedure are very satisfactory.


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Congenital convex pes valgus (CCPV), also known as congenital vertical talus, is a rare condition. There are few reports of the long-term results of operations performed by a single surgeon, using the same method and with a comprehensive review by an independent examiner. We describe such a series. The surgical approach incorporated a posterior, medial and lateral release and transfer of the tendon of tibialis anterior to the neck of the talus.

**Patients and Methods**

From operating-theatre records we identified 12 patients who had had surgical correction of congenital convex pes valgus (CCPV) at our hospital between 1980 and 1990. Three case notes could not be retrieved and one patient had moved abroad since the operation. Eight patients were invited to attend for clinical review, but one failed to do so. Three cases were bilateral. We therefore reviewed ten feet in seven patients.

The mean follow-up was nine years (6 to 14) and the mean age at review 12 years (9 to 17). Details of the children are shown in Table I. At the time of diagnosis the navicular remained dorsally displaced relative to the talus on the lateral radiograph in maximum plantar flexion in all cases. One child (case 2) had the clinical picture of cerebral palsy with total body involvement and developmental delay associated with a chromosomal deletion. No child had arthrogryposis, myelomeningocele or spinal muscular atrophy. The others were neurologically normal, attended mainstream school and participated in appropriate sporting activities for their age. In one child (case 7) there was a family history of both CCPV and congenital absence of the extensor tendons to the middle and ring fingers of both hands. His father had not received treatment for his feet but wanted it for his son.

Operation was carried out at a mean age of 31 months by the senior author (JF) using a similar technique on each occasion. Bilateral cases were operated on sequentially with an interval of two weeks between each foot. Soft-tissue release of the posterior, medial and lateral tethers was carried out together with transfer of the tibialis anterior tendon to the neck of the talus. Three separate skin incisions were used. Elongation of tendon Achilles and capsulotomy of the subtalar and ankle joints were performed through a straight posterior incision. A separate medial incision was used to mobilise and reduce the talonavicular joint, shorten the tibialis posterior tendon and to mobilise the tibialis anterior tendon in order to allow transfer through a drill-hole in the neck of the talus. A third lateral incision was used to lengthen the tendons of peroneus longus and brevis, extensor digitorum communis, and peroneus tertius, when necessary. Lengthening of the peroneus brevis was not carried out in one case (case 3; right foot).
After reduction of the midfoot on the hindfoot a Kirschner wire was passed across the talonavicular joint to maintain the position. The wire was removed under general anaesthesia at six weeks and immobilisation in plaster maintained for a total of 12 weeks after operation.

At clinical review each patient completed a questionnaire relating to pain, function and satisfaction with treatment, similar to that used by Laaveg and Ponseti. We measured foot length, width and circumference using a foot-measurement tool and leg length using a tape measure. Calf and thigh circumference were measured at a distance 25% of the total leg length above and below the lateral line of the knee. The passive range of movement of the ankle and subtalar joints was measured using a hand-held, long-limbed goniometer. Fixed forefoot deformity on the hindfoot was also recorded.

Standing anteroposterior (AP) and lateral radiographs were taken. On the AP projection the talo-first-metatarsal and calcaneo-fifth-metatarsal angles were measured. The talo-first-metatarsal angle was measured on the lateral film. All radiological measurements were made according to the recommendations of Simons, and compared with the normal range of values obtained by Vanderwilde et al.

Standing clinical photographs were obtained of all feet (Fig. 1).

**Results**

The results of the questionnaire are presented in Table I. No child had had further surgery since the initial correction. All patients were able to wear normal footwear, although one boy (case 3), whose mother is a physiotherapist, wore total contact insoles. The same child was also unhappy with the appearance of his right foot, which had some residual forefoot abduction. He had no functional limitations and was satisfied with the overall result. The patient (case 5) with the worst results had developed a cavovarus deformity of the foot.

**Table I.** Details of the patients and the results of the questionnaire. Hamanishi groups are based on the underlying condition present in 50% of patients with CCPV: group 1, neural-tube defects; group 2, neuromuscular disorders; group 3, malformation syndromes; group 4, chromosomal aberrations; and group 5, idiopathic

<table>
<thead>
<tr>
<th>Case</th>
<th>Side</th>
<th>Coexistent conditions</th>
<th>Age at surgery (mth)</th>
<th>Age at follow-up (yr)</th>
<th>Pain max 20</th>
<th>Function max 20</th>
<th>Satisfaction max 20</th>
<th>Comments and Hamanishi group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Left Right</td>
<td></td>
<td>19</td>
<td>17</td>
<td>18</td>
<td>20</td>
<td>20</td>
<td>Group 5</td>
</tr>
<tr>
<td>2</td>
<td>Left Right</td>
<td>Chromosome 18 deletion</td>
<td>58</td>
<td>11</td>
<td>24</td>
<td>16</td>
<td>20</td>
<td>Group 4 Chromosome deletion</td>
</tr>
<tr>
<td>3</td>
<td>Left Right</td>
<td></td>
<td>26</td>
<td>13</td>
<td>24</td>
<td>20</td>
<td>20</td>
<td>Total contact insoles Group 5</td>
</tr>
<tr>
<td>4</td>
<td>Right</td>
<td>Pierre Robin syndrome, congenital heart disease, Left CTEV</td>
<td>22</td>
<td>9</td>
<td>30</td>
<td>20</td>
<td>16</td>
<td>Group 3</td>
</tr>
<tr>
<td>5</td>
<td>Right</td>
<td></td>
<td>29</td>
<td>9</td>
<td>6</td>
<td>4</td>
<td>12</td>
<td>Cavovarus deformity Group 5</td>
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<tr>
<td>6</td>
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<td></td>
<td>31</td>
<td>11</td>
<td>24</td>
<td>20</td>
<td>16</td>
<td>Possible spinal dysraphism Group 1</td>
</tr>
<tr>
<td>7</td>
<td>Left</td>
<td>Bilateral congenital absence of extensor tendons in the hands</td>
<td>26</td>
<td>15</td>
<td>24</td>
<td>20</td>
<td>16</td>
<td>Father had bilateral CCPV, both had bilateral congenital absence of extensor tendons affecting the hands Group 3</td>
</tr>
</tbody>
</table>

**Table II.** The Laaveg-Ponseti questionnaire

**Satisfaction (20 points)**

I am:

- a) Very satisfied with the end result  
- b) Satisfied with the end result  
- c) Neither satisfied nor unsatisfied with the end result  
- d) Unsatisfied with the end result  
- e) Very unsatisfied with the end result

**Function (20 points)**

In my daily living, my foot:

- a) Does not limit my activities  
- b) Occasionally limits my strenuous activities  
- c) Usually limits me in strenuous activities  
- d) Limits me occasionally in routine activities  
- e) Limits me in walking

**Pain (30 points)**

My foot:

- a) Is never painful  
- b) Occasionally causes mild pain during strenuous activities  
- c) Usually is painful after strenuous activities only  
- d) Is occasionally painful during routine activities  
- e) Is painful during walking
five years after surgery. This was painful after walking for 10 to 15 minutes and limited her walking distance; she was, however, neither satisfied nor dissatisfied with the clinical result.

Clinical measurements showed that two children had a leg-length discrepancy of more than 1 cm (cases 6 and 7). When the children with unilateral CCPV were considered the affected foot was, on average, 1.3 cm shorter and 1 cm narrower than the normal side. There was no difference in the circumference of the thigh measured standing, but that of the calf was 1.5 cm smaller on the affected side. The small number of patients does not allow meaningful statistical comparisons.

The mean range of ankle dorsiflexion was 17°, plantar flexion 21°, and the combined arc of subtalar inversion and eversion 27°. All patients were able to walk on tip-toes with their knee extended and to walk on their heels.

All the radiological measurements were within the normal range. Irregularity of the talonavicular joint was common (Fig. 1d) but there was no evidence of necrosis of the body of the talus.

Discussion

Congenital convex pes valgus was first described by Henken in 1914. Several synonyms for the condition are in use including congenital rocker-bottom foot, congenital convex foot and congenital vertical talus. The condition is a dorsolateral dislocation of the midfoot on the hindfoot. The equinus position of the hindfoot is thought to be secondary to the dislocation of the talocalcaneonavicular joint, and for this reason the term congenital convex pes valgus is preferred to congenital vertical talus. The condition is associated with other abnormalities of the central nervous or musculoskeletal systems in at least 50% of cases. Hama-nishi has proposed a classification of CCPV according to the concomitant neuromuscular defect, malformation syndrome or chromosomal abnormality.

The incidence of CCPV is unknown. Osmond-Clarke encountered one child with CCPV for every 120 with congenital talipes equinovarus. Boys are affected more often than girls with up to 71% of cases being bilateral.

The appearance of the foot has been likened to a Persian slipper. The sole of the foot is convex and the dorsum concave. The forefoot is abducted, pronated and dorsiflexed at the midtarsal joint. The head of the talus is prominent on the medial and plantar aspects. The hindfoot is in equinus and valgus. Some believe that the foot deformity is rigid at birth, but this is not universally accepted. Colton believes that CCPV probably represents the most severe deformity in a spectrum of abnormality which includes all forms of pes planovalgus. The diagnosis is made using lateral radiographs taken in maximal dorsiflexion and plan-
tar flexion. In a true CCPV the navicular remains dorsally dislocated in plantar flexion.

The key features of the pathological anatomy are dorsal dislocation of the talocalcaneonavicular joint with secondary equinus of the hindfoot, leading to the vertical orientation of the talus. The proximal articular surface of the navicular faces plantarwards, articulating with the dorsal surface of the talus. The relationship between the talus and the calcaneus has traditionally been described as abnormal. Recently, Seringe has shown that this is preserved, but that the whole hindfoot is in equinus, leading to an apparent increase in the anteroposterior talocalcaneal angle. There is shortening of the long tendons on both the dorsal and lateral aspects of the foot. There is also displacement of the tibialis posterior and peroneal tendons anterior to the axis of the ankle so that they act as midfoot dorsiflexors on the plantar flexed hindfoot. There is shortening of the ligaments on the dorsal and lateral aspects of the foot with stretching of those on the plantar and medial aspects.

It is generally accepted that the treatment of CCPV is surgical, but that the timing and the precise procedure required to correct the deformity are contentious. It is essential to recognise that CCPV does not delay walking, and if a delay is noted then an underlying cause must be sought before treatment commences. Surgery was performed relatively late in our series at a mean age of 31 months. We elected to postpone surgery until the child could stand and walk in those patients showing developmental delay. In some patients surgery was also delayed due to late referral. This explains the differences between the ages at operation of the children in our series and those of Seimon and Wirth et al who advocate surgery at a younger age. The surgical technique of Seimon involves soft-tissue releases of the dorsal structures alone. This may be the method of choice in the younger child in whom secondary fixed deformities have not yet developed.

Dodge et al have reported the largest series of patients with surgically corrected CCPV; a retrospective series of 36 feet in 21 patients. The mean follow-up was 14 years. All had had a variety of procedures performed by different surgeons. They were unable to show any differences between the groups of patients treated using the alternative approaches. In their series, 27% wore custom footwear or a brace. All our patients wore normal shoes.

Our approach was developed from the technique devised by Stone and Lloyd-Roberts in which a posterior release and naviculectomy were performed. They advocated transfer of the tibialis anterior to the neck of the talus to maintain the reduction of the talonavicular joint. Colton described the results of surgery in seven patients with unilateral CCPV, using Lloyd-Roberts’ technique. Four of the seven patients had good or excellent results, but three deformities recurred and were judged to be fair or poor.

De Rosa and Ahlfeld presented the results of surgery in ten feet in seven patients with non-paralytic CCPV. They used a technique similar to ours, and had three excellent, three good and four fair results at a mean follow-up of nearly seven years. The four fair results were symptomatic. Two feet had gross forefoot abduction and two had medial plantar callosities. They proposed that naviculectomy was not necessary, but recommended the continued use of tibialis anterior transfer. We have also found that naviculectomy is unnecessary if a full release of the talocalcaneonavicular joint is performed from the medial and lateral sides.

Napiontek reported the results of surgery in 23 children (32 feet) with a nine-year follow-up. The extent of the surgical release was tailored to the severity of the deformity and 17 feet had a correction similar to that carried out in our series. After a mean of 2.2 years, 25% of feet required further surgery. The preoperative deformity, the initial procedure performed and the indications for subsequent operation were not reported. Changes in the shape of the bones of the hindfoot were noted in 29 feet with “some cases resembling osteoarthritis”. Avascular necrosis of the head of the talus was found in one-third of the feet. Irregularity of the talonavicular joint was present in all our cases and may have been due to the routine use of temporary fixation by a Kirschner wire. No avascular changes were seen in the body of the talus. Napiontek’s lateral release includes division of the lateral part of the talocalcaneal interosseous ligament which may be relevant. We did not do this.

None of the children has had further surgery since the initial correction. One foot (case 3) had residual forefoot abduction which may reflect a failure to release the peroneus brevis, but this did not result in any functional limitation. The cavovarus deformity in case 5 may represent overcorrection. It was not apparent until five years after operation, and may require surgical treatment in the future.

It appears that different surgical approaches to CCPV are required in children of differing ages. It is recommended that for children aged from three to four years a concomitant Grice extra-articular arthrodesis be performed to maintain correction. Under the age of two years good results have been reported with less extensive dorsal soft-tissue surgery. For children around two to three years of age whose walking and standing potential has been established, we believe that our approach to CCPV produces good medium-term results.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References


